



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center
Fisheries Ecology Division
110 Shaffer Road
Santa Cruz, California 95060

March 27, 2013

Project Instructions

Date Submitted: April 19, 2013
Platform: *Ocean Starr*
Cruise Number: OS - 13 - 05
Project Title: Rockfish Recruitment and Ecosystem Assessment
Cruise Dates: May 9 – July 6, 2013

Prepared by: *Keith M. Sakuma* Dated: April 19, 2013
Keith Sakuma
Cruise Leader
NOAA NMFS SWFSC FED

Approved by: *Steve Lindley* Dated: April 24, 2013
Steve Lindley
Laboratory Director
NOAA NMFS SWFSC FED

Approved by: *Francisco Werner* Dated: April 29, 2013
for Francisco Werner
Science and Research Director
NOAA NMFS SWFSC



I. OVERVIEW

Cruise Period: May 9 – July 6, 2013

Operating Area: San Diego, CA to La Push, WA (see Appendix I and II for specifics)

Summary of Objectives

1. Sample for pelagic juvenile rockfish (*Sebastes* spp.) and other epi-pelagic micronekton.
2. Characterize prevailing ocean conditions and examine prominent hydrographic features.
3. Map the distribution and abundance of krill (Euphausiacea).
4. Observe seabird and marine mammal distribution and abundance.
5. Collect Humboldt squid (*Dosidicus gigas*).
6. Examine feeding habits and distributions of jellyfish.
7. Collect adult Pacific sanddabs (*Citharichthys sordidus*).
8. Conduct deep midwater trawls to examine mesopelagic species.
9. Examine ichthyo- and zooplanktonic species composition and abundance at fronts.
10. Collections for stable isotope analysis.

Participating Organizations

NOAA NMFS SWFSC FED

NOAA NMFS NWFSC

NOAA Teacher at Sea Program

University of California Santa Cruz (UCSC)

Farallon Institute for Advanced Ecosystem Research (FIAER)

San Diego State University (SDSU)

University of California Davis (UCD)

San Francisco State University (SFSU), Romberg Tiburon Center for Environmental Studies

Humboldt State University (HSU)

College of Earth, Ocean, and Atmospheric Sciences (CEOAS), Oregon State University (OSU)

Pacific States Marine Fisheries Commission (PSMFC)

Oregon Institute of Marine Biology (OIMB), University of Oregon (UO)

Hopkins Marine Station, Stanford University

Personnel

Leg 1 (May 9 – May 29)

Night Shift

Keith Sakuma, Fishery Biologist, NMFS SWFSC FED (Cruise Leader)
John Field, Fishery Biologist, NMFS SWFSC FED (Chief Scientist) (May 9-22)
Ken Baltz, Oceanographer, NMFS SWFSC FED (May 9-15)
Heidi Fish, Fishery Biologist, NMFS SWFSC FED (May 9 – 15)
Emily Slesinger, Krill Biologist, UCSC (May 9-15)
Lewis Barnett, Ecologist, UCD (May 15-22)
Sarah Wheeler, Ecologist, SDSU (May 15-22)
Brianna Michaud, Krill Biologist, UCSC (May 15-29)
Lindsey Lefebvre, Fisheries Technician, NMFS SWFSC FED (May 22-29)
Amber Payne, NOAA Corp., NMFS SWFSC FED (May 22-29)
Kaia Colestock, Intern, NMFS SWFSC FED (May 22-29)
Patty McGinnis, NOAA Teacher at Sea (May 22-29)

Day Shift

Don Pearson, Fishery Biologist, NMFS SWFSC FED
Sophie Webb, Ornithologist, FIAER
Allison Johnson, Technician, SFSU (May 9-22)
Jamie Lee, Technician, SFSU (May 22-29)

Leg 2 (May 31 – June 20)

Night Shift

Keith Sakuma, Fishery Biologist, NMFS SWFSC FED (Cruise Leader)
Ken Baltz, Oceanographer, NMFS SWFSC FED
Sabrina Beyer, Fisheries Technician, NMFS SWFSC FED (May 31 – June 6)
Amber Payne, NOAA Corp., NMFS SWFSC FED (May 31-June 6)
TBA, Krill Biologist, UCSC (May 31 – June 6)
Thomas Adams, Volunteer NMFS SWFSC FED (June 6-20)
Roxanne Robertson, Technician, HSU (June 6-13)
Erin Damm, Technician, HSU (June 6-13)
TBA, Krill Biologist, UCSC (June 6 – June 13)
Jason Phillips, Fishery Biologist, PSMFC (June 13 – June 20)
TBA, Krill Biologist, UCSC (June 13 – June 20)

Day Shift

Sophie Webb, Ornithologist, FIAER (May 31-June 6)
Lindsey Lefebvre, Fisheries Technician, NMFS SWFSC FED (May 31-June 6)
Amber Payne, NOAA Corp., NMFS SWFSC FED (June 6-June 13)
Rebecca Miller, GIS Technician, NMFS SWFSC FED (June 13-20)

Leg 3 (June 22 –July 6)

Richard Brodeur, Fishery Biologist, NMFS NWFSC (Chief Scientist)

Jason Phillips, Fishery Biologist, PSMFC

Victor Simon, Fishery Biologist, NMFS NWFSC

Ken Baltz, Oceanographer, NMFS SWFSC FED

Caren Barceló, PhD Student CEOAS OSU

Toby Auth, Fishery Biologist, PSMFC

Michelle Stowell, MS Student, CEOAS OSU

Leif Rasmuson, PhD Student, OIMB OU

Julia Adams, Intern, OSU (June 22-28)

Delvan Neville, Radioecologist, OSU (June 22-28)

Keith Bosley, Fishery Biologist, NMFS NWFSC (June 28-July 6)

Curtis Roegner, Fishery Biologist, NMFS NWFSC (June 28-July 6)

Scientist Duty Hours

Nighttime Trawling & CTD 2000-0600

Daytime CTD 0600-2000

Administrative**Point of Contact**

Keith Sakuma, Fishery Biologist,

NOAA NMFS SWFSC FED

110 Shaffer Road

Santa Cruz, CA 95060

Phone: 831-420-3945

Email: keith.sakuma@noaa.gov

Licenses and Permits

Operations within the Channel Islands National Marine Sanctuary (CINMS) are approved under permit CINMS-2012-003. Permitted activities include the use of mid-water sampling gear as well as CTDs. All other activities are subject to CINMS regulations.

If hook and line fishing is permitted, the fisher must be in compliance with all local/regional fishing regulations. While off CA, you must have a valid CA recreational fishing license in order to be allowed to retain any catch and all daily bag limits and prohibited closed area restrictions must be followed. No fish or invertebrates taken with scientific sampling gear may be sold, or bartered, although consumption of captured species aboard the vessel is allowed if regulations (area/species/bag limits) are followed.

II. OPERATIONS

Itinerary

Leg 1: May 9 – May 29

Mobilize scientific gear from NOAA NMFS SWFSC FED Santa Cruz, CA to the ship at San Francisco, CA on May 8. On May 9, embark all scientific personnel and depart San Francisco to begin scientific operations and conduct trawling and CTD sea trials off central California during the daylight hours prior to the first night of operations. Beginning the first night after sea trials and ending the morning of the last day of Leg 1, conduct nighttime mid-water trawls, CTD deployments, bongo tows, various oceanographic sampling, seabird/marine mammal observations, opportunistic Humboldt squid jigging, and deep midwater trawls between San Diego, CA and Cape Mendocino, CA. The daily transect plan for Leg 1 is listed in Appendix I and is subject to change. There will be a transfer of scientific personnel via skiff on May 15 and again on May 22. Arrive in port in San Francisco upon the completion of Leg 1 operations on May 29. One full day will be spent in port at a San Francisco Pier on May 30. San Francisco pier TBD.

Leg 2: May 31 – June 20

Embark Leg 2 scientists on May 31. Beginning the first night of Leg 2 and ending the morning of the last day of Leg 2, conduct nighttime mid-water trawls, CTD deployments, bongo tows, various oceanographic sampling, seabird/marine mammal observations, opportunistic Humboldt squid jigging, and deep midwater trawls between San Diego and Cape Mendocino. The daily transect plan for Leg 2 is listed in Appendix I and is subject to change. There will be a transfer of scientific personnel via skiff on June 6 and again on June 13. Arrive in port in Eureka upon the completion of Leg 2 operations on June 20. One full day will be spent in port at a Eureka Pier on June 21. Eureka Pier TBD.

Leg 3: June 22 – July 6

Embark Leg 3 scientists and depart Eureka Pier on June 22. Beginning the first night of Leg 3 and ending the morning of the last day of Leg 3, conduct nighttime mid-water trawls, CTD deployments, various oceanographic sampling, MultiNet plankton sampling, neuston tows, and video tows for jellyfish between Cape Mendocino and La Push, WA. The daily transect plan for Leg 3 is listed in Appendix I and is subject to change. There will be a transfer of scientific personnel with a short port stop in Newport (OSU dock) on June 28. Arrive in port in Newport, OR, upon the completion of Leg 3 operations on July 6. All scientists will be disembarked on July 6 and much of the gear will be stowed aboard ship for later demobilization on July 23 in San Francisco.

Staging and De-staging

On May 8 scientific survey equipment from NOAA NMFS SWFSC FED will be loaded and secured aboard the ship while in port in San Francisco. Scientists request the ability to stay

aboard the ship the night of May 8 and during all in port periods. Frozen specimens will be offloaded and miscellaneous gear will be loaded and offloaded during each in port. Although the survey ends at Newport on July 6, almost all equipment will be left aboard until July 23 when the NOAA NMFS SWFSC FED Salmon Ecology Nordic 264 rope trawl survey ends in San Francisco. On July 23, all gear from the two NOAA NMFS SWFSC FED surveys will be offloaded and returned to Santa Cruz.

A skiff maybe needed to embark/disembark scientists and miscellaneous gear if operational or staffing needs require exchanges. Skiff exchanges may occur at the following locations off CA; San Diego, Channel Islands Harbor, Santa Barbara, Morro Bay, Avila Beach, Monterey Harbor, Santa Cruz Harbor, Pillar Point Harbor at Half Moon Bay, San Francisco, Horseshoe Cove at Sausalito, Drake's Bay Pier, Bodega Bay Harbor. Exchange locations will depend upon operational status and/or location adjustments due to weather.

Operations to be Conducted

1. Sample for pelagic juvenile rockfish and other epi-pelagic micronekton

Four to seven midwater trawls of 15 minute duration will be conducted each night along a transect. A modified-Cobb midwater trawl with a 26 m (86') headrope and a 9.5 mm (3/8") codend liner will be used. Trawling operations will commence just after dusk and conclude just before dawn. Target headrope depths is 30 m except in areas with shallow bottom depths, in which case the target headrope depth is 10 m,. We will start with 25 and 85 m of wire out, with adjustments made if target depths are not obtained, as determined from depth recordings collected from TDRs and the ship's acoustic trawl net monitoring system. The TDR and acoustic sensors will be attached to the net during each tow. Ship speed during trawling should be ~2.0 knots. Ship's speed will be adjusted while trawling to maintain target headrope depth (using the acoustic trawl net monitoring system) while the amount of wire out will remain fixed. Two STM Products Dolphin Dissuasive Device (DDD 03) acoustic pingers will be attached to the trawl to mitigate encounters with marine mammals. Fish and select invertebrates from each trawl will be sorted, identified and enumerated. Length measurements will be taken on adult northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax*), Pacific herring (*Clupea pallasii*) and Pacific whiting (*Merluccius productus*), as well as pelagic juvenile Pacific whiting, lingcod (*Ophiodon elongatus*), Pacific sanddab, speckled sanddab (*Citharichthys stigmaeus*), and sablefish (*Anaplopoma fimbria*) and Humboldt squid, and market squid (*Doryteuthis opalescens*). Length measurements will also be taken on a subsample of mesopelagics including California headlightfish (*Diaphus theta*), *Nannobranchium* spp., California lanternfish (*Symbolophorus californiensis*), northern lampfish (*Stenobranchius leucopsarus*), blue lanternfish (*Tarletonbeania crenularis*), California smoothtongue (*Leuroglossus stilbius*), and blacksmelts (Bathylagidae). Size information will also be recorded for *Chrysaora* spp., *Aurelia* spp., *Pyrosoma* spp., *Thetys* spp., and *Carinaria* spp. All pelagic juvenile rockfish will be frozen for later laboratory analyses.

2. Characterize prevailing ocean conditions and examine prominent hydrographic features

CTD casts will be conducted throughout the day at pre-determined stations in the vicinity of the trawl transects and at each trawl station at night. The scientific party may exclude some CTD casts during daytime and/or nighttime operations in order to complete the planned mid-water trawls. A Seabird Electronics CTD and water sampling system with conductivity, temperature, depth, fluorometer, transmissometer, photosynthetically active radiation (PAR), and dissolved oxygen sensors will be used. The CTD will be lowered to a maximum depth of 520 meters, as bottom depth allows. Deployment rate: soak for 2 minutes at 10 meters depth, then beginning at the surface - 45 meters/minute on the downcast, and 60 meters/minute for the upcast. Water samples will be taken during the upcast for chlorophyll and nutrient samples. Occasionally CTD casts to 1000 meters depth will be deployed in order to examine the oxygen minimum layer. A scientist from SFSU Romberg Tiburon Center for Environmental Studies will be taking additional water samples from the area around Point Reyes and the Farallon Islands to examine chlorophyll, primary productivity, and inorganic nutrients. An incubation table will be setup outside on the aft deck requiring a flow-through seawater source. Oceanographic data will also be collected while underway by a Turner Designs SCUFA fluorometer and SeaBird thermosalinometer. The Simrad EK60 echosounder will be used to acoustically characterize the distribution and abundance of macrozooplankton and micronekton, meroplankton and zooplankton associated at prominent oceanographic features and locations.

3. Map the distribution and abundance of krill

A series of daytime transects will be run, during which the Simrad EK60 echosounder will be used to record and geo-reference the presence and abundance of krill. The EK-60 will be operated at 38, 70, 120 and 200 kHz and interfaced to a data acquisition system to estimate small pelagic and krill biomass between 10 and a maximum of 750 m. The vessel's EQ-50, ES-60 or Skipper depth sounder may be used minimally at the discretion of the captain, but will normally remain off while underway. The ship shall inform the chief scientist/cruise leader of any use of the vessel's sounders, as it interferes with the signals received on the EK-60 that will be used continuously. Each night prior to the first mid-water trawl, a discrete depth bongo tow (0.505 mm mesh nets and 0.333 mesh codends) will be conducted in order to capture small/early life stages of krill. Towing depth and duration should be similar to the first planned nighttime mid-water trawl at that station (e.g. first trawl target headrope depth is 30 m then the bongo net will be towed at 30 m). Contents of the two codends will be preserved in formalin and ethanol. Additional bongo tows may be conducted at night depending upon krill catches and time constraints.

4. Observe Seabird and marine mammal distribution and abundance

Ornithologists/marine mammal biologists from the Farallon Institute for Advanced Ecosystem Research will visually survey and estimate abundance and distribution of seabirds and marine

mammals from the Ship's flying bridge during daylight hours while underway. If species of particular interest are encountered, the Ship may be asked to alter course accordingly.

5. Collect Humboldt squid

As time allows, hook and line fishing for Humboldt squid will be conducted within the survey area at depths down to 300 meters. Ideally, we would like to fish for the squid during each nighttime CTD deployment. Large weighted squid jigs will be used as lures, and gaffs and spear/handline will be used to bring the squid aboard after the squid is reeled to the surface. Once the squid is aboard morphometrics and gender will be recorded and the stomach and head will be removed and frozen. When possible, a subsample of captured adult squid will be tagged with a satellite pop-up tag and released alive. A subsample of whole specimens will be frozen.

6. Examine feeding habits and distribution of jellyfish

During Legs 1 and 2, in areas with a high concentration of jellyfish (e.g. the Gulf of the Farallones and inside Monterey Bay) a dip net will be used to collect single specimens of *Chrysaora fuscescens* and/or *Aurelia* spp. Individual specimens will be preserved in 10% formalin. To gather data on available prey items, a 0.5m diameter, 200 micron ring net will be used to collect zooplankton. While the boat is stopped, the weighted net will be lowered vertically to a point about 5 meters above the bottom, or to a maximum depth of 100m at stations deeper than 100m, and held there for 10 seconds. The net will be retrieved at a constant rate of 30m/min. Once on deck, net contents will be rinsed down with a seawater deck hose into the codend and transferred to a storage jar with 5% buffered formalin preservative. During Leg 3, daytime, vertical video tows will be conducted with a portable, submersible camera to characterize distributions of large jellyfish, including *C. fuscescens*, *Aurelia* spp. and *Aequorea* spp. The camera can be deployed alone or attached to the CTD cage. Tows will be conducted at regular transect locations. Time permitting, additional tows will be conducted at fronts, for example near the mouth of the Columbia River, to establish patterns of aggregation at water mass interfaces. These additional sampling locations will be identified based on satellite imagery and the sea surface temperature gradient. At these locations, horizontal tows will be conducted through water masses on each side of the front and video tows will be done in conjunction with stratified MultiNet tows (see below). The camera will either be attached to the MultiNet or towed simultaneously at a similar distance behind the vessel.

7. Collect adult Pacific sanddabs

As time allows, hook and line fishing for adult Pacific sanddabs will be conducted to examine maturity stages and spawning condition. Size and sex will be recorded and the heads frozen for otolith extraction and the gonads preserved in formalin for histology.

8. Conduct deep midwater trawls to examine mesopelagic species

As time allows, a deep midwater trawl will be conducted to examine mesopelagic species, in particular myctophids (Myctophidae). To reach appropriate depths, more than 1000 m of warp will need to be let out. Due to the amount of time needed to deploy and retrieve a deep trawl, they will most likely be conducted during the late afternoon prior to the scheduled nighttime trawling operations.

9. Examine ichthyo- and zooplanktonic species composition and abundance at fronts

During leg 3, in the vicinity of trawl transects, sampling a total of at least 4 fronts of each type: density and/or primary productivity bloom fronts will be attempted. At each front, a total of 3 front crossings (ship will need to travel perpendicular to front) will be needed while a MultiNet is deployed. During each crossing, the horizontally towed MultiNet will have each of the 5 nets triggered by an on deck operator (C. Barceló and/or technician), such that 2 samples are collected on one side of the front, one sample within the front and two samples on the other side of the front. This process will be repeated 3x at each front. Distance between transects will be decided pending ocean conditions but will likely be on the order of ½ km. Towing speed of the MultiNet at the depth (within the first ~10 m of the water column) of the strongest gradient will be at a maximum of 3 knots. After each crossing, the MultiNet will be retrieved from the water and the contents of the nets will be concentrated at the codends and identified, preserved and/or discarded. Gelatinous zooplankton will be identified to species and counted from within each of the net samples. Larval fish and invertebrates will be preserved in formalin for later species identification, measurements and counts. Fish and invertebrate eggs will be collected by the continuous underway fish egg sampler (CUFES) in synchrony with the deployed MultiNet. The intake of CUFES will be at 3 m depth, or deeper (depending on strongest front gradient location). Samples will be filtered and counted under a stereo microscope onboard approximately every 10 minutes (synchronized with openings and closings of the MultiNet nets), and if possible, with higher temporal resolution (every 3 minutes) while in close proximity to fronts. Surface distributions of fish and zooplankton will be sampled with a Manta style neuston net (1.5 × 0.5 m mouth; 300 µm mesh). The neuston net is to be towed for 5 min at ~1 m/s (~2 knots), and will have a General Oceanics flowmeter to determine volume of water filtered. The bridle of the tow line is customarily rigged so the net fishes outside the wake of the ship. The neuston net can be deployed while underway either before reaching a station or immediately after other activities are complete. The neuston net will fish opportunistically at night and around frontal features in concert with MultiNet activities during the day.

10. Collections for stable isotope analysis

(For Steve Litvin and Aaron Carlisle, Hopkins Marine Station, Stanford University). We will collect samples of zooplankton, krill and other micronekton to provide baseline samples at multiple trophic levels to explore the potential for developing an “isoscape” analysis of the California Current. This will include saving samples from one cod-end for each of the bongo tows (ideally with 333 µm mesh) conducted during the 2013 survey (frozen), and tissue samples

from krill, market squid (ideally in 50 to 100 mm size range, with larger preferred over smaller), adult northern anchovy, Pacific sardine, adult (age 1+) Pacific hake, adult (age 1+) Pacific sand dab, adult northern lampfish and adult California headlightfish. Tissue samples should also be collected from any Humboldt squid encountered (although most likely any squid encountered will be frozen whole). The overall idealized objective will be to collect net and krill samples from each station, and up to five individuals or tissue samples of each species at each station, although it is recognized that this will not be practicable for most stations and species. For larger fish, samples can be taken from muscle tissue and combined in a single bag (as five individual pieces), smaller individuals can simply be frozen whole. We will develop a spreadsheet with stations and species listed with the ability to “check” when a given sample has been collected to track collections. Tissue from shortbelly rockfish and potentially other rockfish species will be sampled during routine analysis of those specimens following completion of the cruise.

Mitigating interaction with marine mammals

The captain, deckhands, and scientists will visually scan the area for marine mammals for a period of no less than 30 minutes before setting the trawl gear. If marine mammals are observed within one nautical mile of the planned set location during the initial visual scan and determined to be at risk of interaction, then the vessel will relocate to a distance one nautical mile away and another visual scan will be conducted at the new location. If marine mammals are still observed after the vessel has moved two times from the original station location, then trawl operations for that particular station will be cancelled and the vessel will proceed to the next planned trawl station.

Whenever the trawl is in the water, the captain/ship operator, the chief scientist/cruise leader and/or scientists and crew standing watch will continue to monitor the waters around the vessel and maintain a lookout for marine mammal presence as far away as environmental conditions allow. The chief scientist/cruise leader should be notified if any marine mammals are observed by the captain, deckhands, and scientists. If the midwater trawl is deployed (but not yet fishing) after an “all clear” visual scan and marine mammals are then observed by the captain, deckhands, or scientists during the trawl deployment then the gear will immediately be retrieved to avoid further interaction with the animals. The vessel will relocate to a distance one nautical mile away and follow the visual scanning protocols noted in the previous paragraph. If the midwater trawl is fishing and marine mammals are observed, then the appropriate action should be taken based upon the individual circumstances with consultation between the scientists and captain (in some cases the net will be immediately retrieved, while in others it may be kept at depth to avoid marine mammals at the surface).

Every effort should be made to deploy and retrieve the trawl net as quickly as possible (following all safety measures) to avoid possible interactions with marine mammals, which tend to aggregate at the surface.

If a marine mammal is inadvertently captured in the trawl net, it will be of the highest priority to release the animal back into the water as soon as is safely possible. The chief scientist/cruise leader will be responsible for recording the event in the data books, noting the status of the

animal (e.g. healthy and alive, injured slightly, etc.), the species, and if possible other details such as sex and relative size. Beginning in 2008, if a marine mammal was captured in the midwater trawl net, the chief scientist/cruise leader immediately notified a NOAA NMFS SWFSC representative on shore via telephone or email and conveyed all the pertinent information regarding the event.

A further measure to mitigate marine mammal encounters is to install acoustic pingers on the midwater trawl net. Two STM Products Dolphin Dissuasive Device (DDD 03) acoustic pingers will be attached to the trawl net to whenever it is deployed to mitigate marine mammal encounters.

III. EQUIPMENT

Requested from the Ship

Trawl winches, and gantries with trawl blocks
Net reel for modified-Cobb mid-water trawl net
Cowbells for securing codend of trawl net
Winch and conductive cable for CTD deployments
Winch for bongo and vertical net tows
Knudsen 12 kHz depth recorder or comparable
Multifrequency transducers providing 38, 70, 120, 200 kHz frequencies for the EK-60
Regular freezer, -80°C freezer, and refrigerator space for water and organism samples
GPS feeds into lab spaces
Acoustic trawl net sounder system with display monitor
CUFES set up flow through system
Chair on the flying bridge for ornithologists/marine mammal biologists
Long-handled gaff(s) for Humboldt squid
Small boat/skiff for transfer of personnel and equipment
Constant temperature room set at 22°C ± 1°C (71.5°F ± 2°F)

Supplied by the Scientists from NOAA NMFS SWFSC and NWFSC

Modified-Cobb mid-water trawl nets (2)
1.5 m x 2.1 m (5' x 7') steel V-doors, mounted (1 pair)
12.7 mm (1/2") x 55 m (180') midwater trawl bridle cables (4)
Transfer cables, door legs, and rigging hardware for trawl net
STM Products DDD 03 acoustic pingers
Seabird CTD with carousel and water bottles interfaced with deck units and PC
Bongo net frame, weights, nets, and codends
Inclinometer for bongo tows
MultiNet
Neuston net
Flowmeters
Underwater video camera setup
Specimen sorting, enumeration, and preservation equipment
Simrad EK-60 GPTs and software

Thermosalinometer connected to PC
SCUFA fluorometer connected to PC
TDRs
Bucket thermometer and seawater sample buckets
Seawater/chlorophyll sample filtering equipment
GAST vacuum pumps
Seawater incubator (SFSU Romberg Tiburon Center)
PC laptop computers running Windows OS
Microscopes, dissecting equipment, and field guides
Krill sorting and enumeration equipment
Fishing poles, tackle, and jigs
Humboldt squid processing/preservation gear
Pacific sanddab processing/preservation gear
Jellyfish processing/preservation gear
Long handled nets for jellyfish collection
Large coolers
Mustang float coats and foul weather gear
Quart and pint canning jars
Ethanol (20 liters)
Formalin (20 liters)
Sodium bicarbonate (NaHCO_3) 10mmol (100mmol in 100ml)
MSDS sheets for all chemicals

IV. HAZARDOUS MATERIALS

The chief scientist/cruise leader shall be responsible for complying with OMAO Procedure ENV 01-09 (or the OMAO procedure that supersedes them). MSDS and appropriate neutralizing agents, buffers, and/or absorbents in amounts adequate to address spills of a size equal to the amount of chemicals will be brought aboard. The amount of hazardous material arriving and leaving the vessel shall be accounted for by the chief scientist/cruise leader.

V. DISPOSITION OF DATA AND REPORTS

Specimen and Data Requests

Every effort will be made to fulfill requests for specimens and data. However, if the request is too large we may require the requestor to provide a person to collect the samples and/or data. Please provide your requests at the earliest possible date to the NOAA NMFS SWFSC FED, Keith Sakuma (831) 420-3945 keith.sakuma@noaa.gov.

Cruise Meetings

A pre-cruise meeting between the scientific party and the ship will be held prior to commencement of operations to identify operational and logistic requirements. A post-cruise meeting will be held between the scientific party and the ship at the termination of the cruise.

VI. MISCELLANEOUS REQUIREMENTS

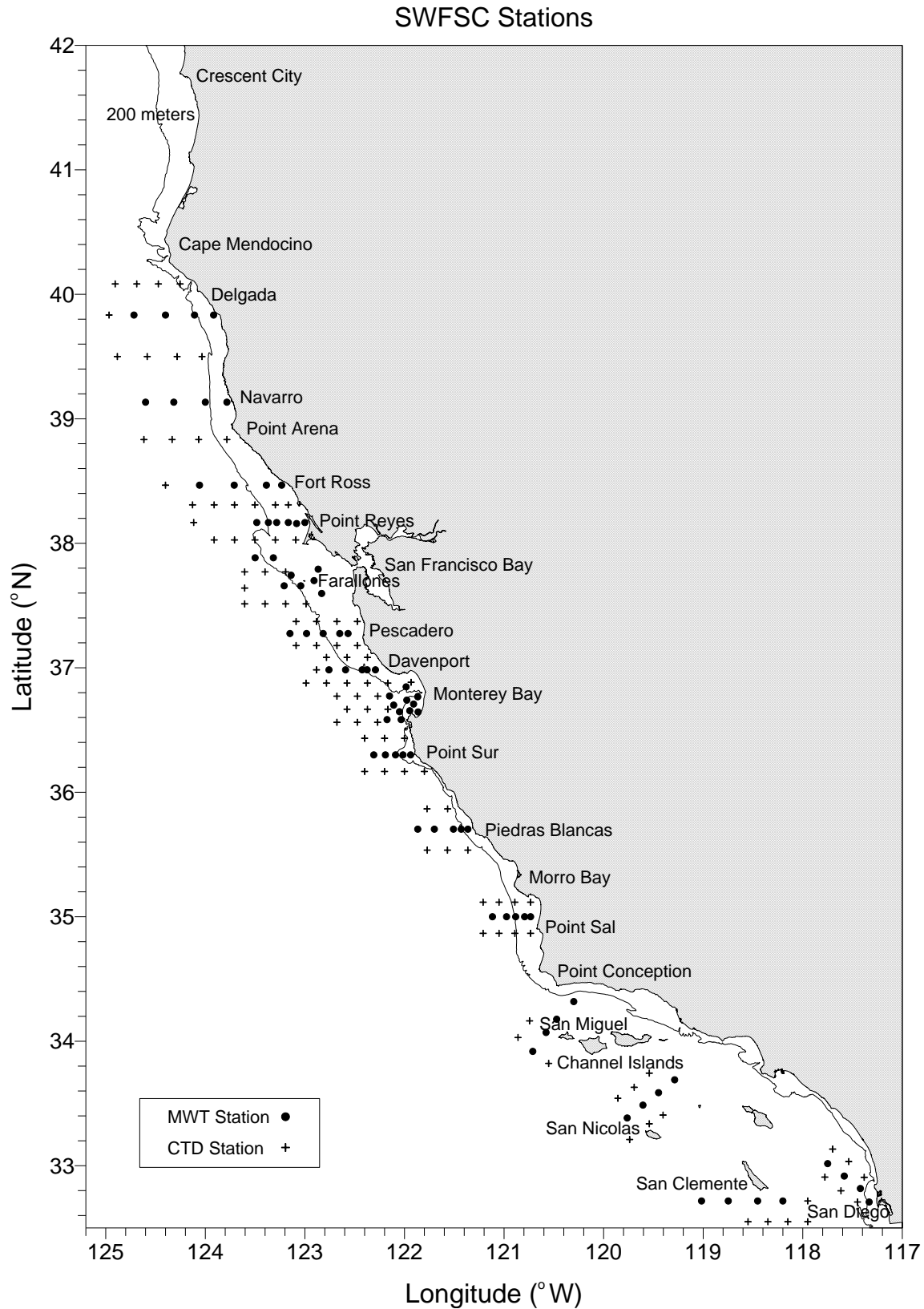
The chief scientist/cruise leader is authorized to alter the scientific portion of this cruise plan with the concurrence of the ship, provided that the proposed changes will not: (1) jeopardize the safety of personnel or the ship; (2) exceed the time allotted for the cruise; (3) result in undue additional expense; or (4) change the general intent of the cruise.

APPENDIX I: DAILY SCHEDULE (TENTATIVE)

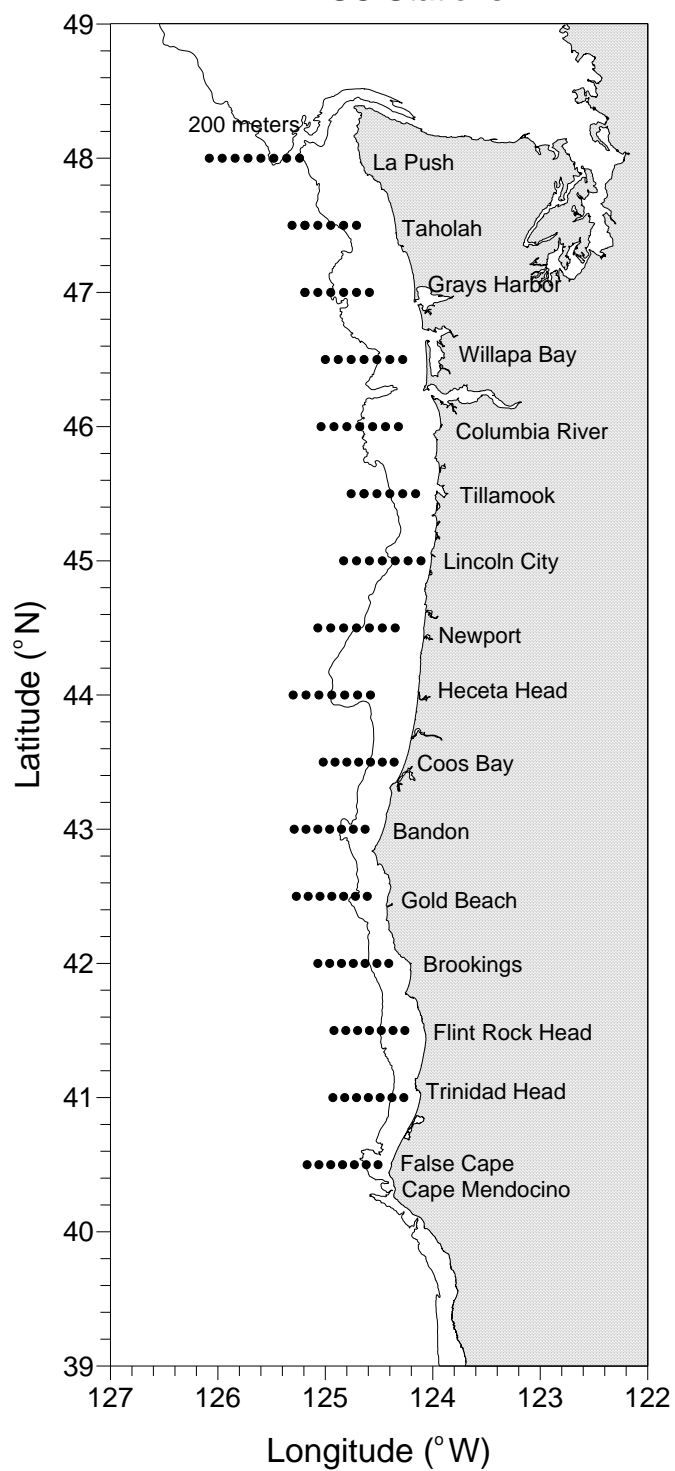
Date	Transect Location	# Sampled	Notes
8-May	S.F. Port		Load and Set Up Gear
9-May	Monterey Inside	1	Depart S.F., CA, Begin Leg 1
10-May	Monterey Outside	1	
11-May	Davenport	1	Saturday
12-May	Pescadero	1	Sunday
13-May	Outside Farallones	1	
14-May	Gulf of Farallones	1	
15-May	Point Reyes	1	Skiff Transfer, Horseshoe Cove, CA
16-May	Monterey Inside	2	
17-May	Point Sur	1	
18-May	Monterey Outside	2	Saturday
19-May	Davenport	2	Sunday
20-May	Pescadero	2	
21-May	Outside Farallones	2	
22-May	Point Reyes	2	Skiff Transfer, Horseshoe Cove, CA
23-May	Fort Ross	1	
24-May	Navarro	1	
25-May	Delgada	1	Saturday
26-May	Point Reyes	3	Sunday
27-May	Davenport	3	Memorial Day
28-May	Pescadero	3	
29-May	End Leg 1		Dock at S.F., CA
30-May	S.F. Port		In Port
31-May	Gulf of Farallones	2	Depart S.F., CA, Begin Leg 2
1-Jun	Monterey Outside	3	Saturday
2-Jun	Piedras Blancas	1	Sunday
3-Jun	Point Sal	1	
4-Jun	San Miguel	1	
5-Jun	San Nicolas	1	
6-Jun	San Clemente	1	Skiff Transfer, Oxnard, CA
7-Jun	San Diego	1	
8-Jun	San Nicolas	2	Saturday
9-Jun	San Miguel	2	Sunday
10-Jun	Point Sal	2	
11-Jun	Piedras Blancas	2	
12-Jun	Point Sur	2	
13-Jun	Outside Farallones	3	Skiff Transfer, Santa Cruz, CA
14-Jun	Fort Ross	2	
15-Jun	Navarro	2	Saturday
16-Jun	Delgada	2	Sunday
17-Jun	False Cape	1	
18-Jun	Flint Rock Head	1	
19-Jun	Trinidad Head	1	
20-Jun	End Leg 2		Dock at Eureka, CA
21-Jun	Eureka		In Port
22-Jun	Brookings	1	Saturday-Depart Eureka, CA, Begin Leg 3
23-Jun	Gold Beach	1	Sunday
24-Jun	Bandon	1	
25-Jun	Coos Bay	1	

26-Jun	Heceta Head	1	
27-Jun	Heceta Head	2	
28-Jun	Newport	1	Transfer, Newport, OR
29-Jun	Lincoln City	1	Saturday
30-Jun	Tillamook	1	Sunday
1-Jul	Columbia River	1	
2-Jul	Willapa bay	1	
3-Jul	La Push	1	
4-Jul	Taholah	1	
5-Jul	Grays harbor	1	
6-Jul	Cruise Ends		Saturday-Dock at Newport, OR

APPENDIX II: MID-WATER TRAWL AND CTD STATION LOCATIONS



NWFSC Stations



SWFSC STATIONS

SAN DIEGO-DAY

OPS	Latitude	Longitude	Depth(m)	Wire Out (m)	Station#
CTD	32° 42.5'	117° 27'	582	520	4041
CTD	32° 47.9'	117° 37'	1020	520	4042
CTD	32° 54.5'	117° 46.7'	1040	520	4043
CTD	33° 08'	117° 42'	810	520	4045
CTD	33° 02'	117° 32.3'	700	520	4046
CTD	32° 54.4'	117° 23'	550	520	4047

SAN DIEGO-NIGHT

OPS	Latitude	Longitude	Depth(m)	Wire Out (m)	Station#
CTD	33° 01'	117° 45'	798	520	481
Trawl	33° 01'	117° 45'	798	85	481
CTD	32° 55'	117° 35'	865	520	482
Trawl	32° 55'	117° 35'	865	85	482
CTD	32° 49'	117° 25.3'	555	520	483
Trawl	32° 49'	117° 25.3'	555	85	483
Trawl	32° 42.5'	117° 20'	94	85	484
CTD	32° 42.5'	117° 20'	94	84	484

SAN CLEMENTE-DAY

OPS	Latitude	Longitude	Depth(m)	Wire Out (m)	Station#
CTD	32° 43'	117° 57'	520	510	4048
CTD	32° 33'	117° 57'	963	520	4049
CTD	32° 33'	118° 09'	1900	520	4050
CTD	32° 33'	118° 21'	1385	520	4051
CTD	32° 33'	118° 33'	1111	520	4052

SAN CLEMENTE-NIGHT

OPS	Latitude	Longitude	Depth(m)	Wire Out (m)	Station#
CTD	32° 43'	118° 12'	1586	520	401
Trawl	32° 43'	118° 12'	1586	85	401
CTD	32° 43'	118° 27.2'	222	212	402
Trawl	32° 43'	118° 27.2'	222	85	402
CTD	32° 43'	118° 44.9'	1253	520	403
Trawl	32° 43'	118° 44.9'	1253	85	403
Trawl	32° 43'	119° 01'	777	85	404
CTD	32° 43'	119° 01'	777	520	404

SAN NICOLAS-DAY

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	33° 24.4'	119° 24.2'	963	520	4002
CTD	33° 20.2'	119° 32.5'	85	75	4003
CTD	33° 12.6'	119° 44.3'	460	450	4004
CTD	33° 32.5'	119° 51.4'	330	320	4006
CTD	33° 37.8'	119° 41.6'	1366	520	4007
CTD	33° 44.6'	119° 32.5'	1930	520	4008

SAN NICOLAS-NIGHT

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	33° 41.4'	119° 17.2'	892	520	411
Trawl	33° 41.4'	119° 17.2'	892	85	411
CTD	33° 35.2'	119° 26.9'	1874	520	412
Trawl	33° 35.2'	119° 26.9'	1874	85	412
CTD	33° 29.2'	119° 36.3'	775	520	413
Trawl	33° 29.2'	119° 36.3'	775	85	413
Trawl	33° 23'	119° 45.8'	103	85	414
CTD	33° 23'	119° 45.8'	103	93	414

SAN MIGUEL-DAY

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	33° 49.3'	120° 33.1'	1819	520	4010
CTD	34° 01.8'	120° 51.6'	948	520	4011
CTD	34° 09.8'	120° 44.6'	738	520	4012

SAN MIGUEL-NIGHT

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	33° 55.1'	120° 42.7'	1848	520	425
Trawl	33° 55.1'	120° 42.7'	1848	85	425
CTD	34° 04.2'	120° 34.7'	190	180	424
Trawl	34° 04.2'	120° 34.7'	190	85	424
CTD	34° 10.6'	120° 28.3'	122	112	423
Trawl	34° 10.6'	120° 28.3'	122	85	423
Trawl	34° 19.1'	120° 18'	380	85	422
CTD	34° 19.1'	120° 18'	380	370	422

POINT SAL-DAY

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	35° 07'	120° 44'	38	30	4070
CTD	35° 07'	120° 53.5'	154	144	4069
CTD	35° 07'	121° 03'	457	447	4068
CTD	35° 07'	121° 12.6'	579	520	4067
CTD	34° 52'	121° 12.6'	564	520	4066
CTD	34° 52'	121° 03'	415	105	4065
CTD	34° 52'	120° 53.5'	221	211	4064
CTD	34° 52'	120° 44'	62	52	4063

POINT SAL-NIGHT

OPS	Latitude	Longitude	Depth(m)	Wire Out (m)	Station#
CTD	35° 00'	120° 44'	55	45	491
Trawl	35° 00'	120° 44'	55	25	491
CTD	35° 00'	120° 47.6'	94	84	492
Trawl	35° 00'	120° 47.6'	94	85	492
CTD	35° 00'	120° 53'	192	182	493
Trawl	35° 00'	120° 53'	192	85	493
CTD	35° 00'	120° 58.5'	374	364	494
Trawl	35° 00'	120° 58.5'	374	85	494
Trawl	35° 00'	121° 07'	532	85	495
CTD	35° 00'	121° 07'	532	520	495

PIEDRAS BLANCAS-DAY

OPS	Latitude	Longitude	Depth(m)	Wire Out (m)	Station#
CTD	35° 32.1'	121° 21.8'	516	506	4023
CTD	35° 32.1'	121° 34.1'	848	520	4024
CTD	35° 32.1'	121° 46.3'	1007	520	4025
CTD	35° 52'	121° 46.4'	968	520	4028
CTD	35° 52'	121° 34'	510	500	4029

PIERAS BLANCAS-NIGHT

OPS	Latitude	Longitude	Depth(m)	Wire Out (m)	Station#
CTD	35° 42.2'	121° 21.8'	60	50	441
Trawl	35° 42.2'	121° 21.8'	60	85	441
CTD	35° 42.2'	121° 25.8'	167	155	442
Trawl	35° 42.2'	121° 25.8'	167	85	442
CTD	35° 42.2'	121° 30.5'	557	520	443
Trawl	35° 42.2'	121° 30.5'	557	85	443
CTD	35° 42.2'	121° 42'	885	520	444
Trawl	35° 42.2'	121° 42'	885	85	444
Trawl	35° 42.2'	121° 52'	1050	85	445
CTD	35° 42.2'	121° 52'	1050	520	445

POINT SUR-DAY

OPS	Latitude	Longitude	Depth(m)	Wire Out (m)	Station#
CTD	36° 10'	121° 48'	498	488	1100
CTD	36° 10'	122° 00'	984	520	1101
CTD	36° 10'	122° 12'	1289	520	1102
CTD	36° 10'	122° 24'	1773	520	1103
CTD	36° 26'	122° 24'	1785	500	1104
CTD	36° 26'	122° 12'	1041	520	1105
CTD	36° 26'	122° 00'	560	550	1106

POINT SUR-NIGHT

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	36° 18'	121° 56.3'	65	55	101
Trawl	36° 18'	121° 56.3'	65	85	101
CTD	36° 18'	122° 00.9'	102	155	103
Trawl	36° 18'	122° 00.9'	102	85	103
CTD	36° 18'	122° 05.4'	354	344	104
Trawl	36° 18'	122° 05.4'	354	85	104
CTD	36° 18'	122° 11.5'	828	520	105
Trawl	36° 18'	122° 11.5'	828	85	105
Trawl	36° 18'	122° 18.5'	928	85	106
CTD	36° 18'	122° 18.5'	928	520	106

MONTEREY BAY INSIDE-DAY

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
TBD					

MONTEREY BAY INSIDE-NIGHT

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	36° 50.8'	121° 59'	91	81	119
Trawl	36° 50.8'	121° 59'	91	85	119
CTD	36° 46'	121° 52'	73	63	114
Trawl	36° 46'	121° 52'	73	85	114
CTD	36° 44.4'	121° 58.6'	287	277	116
Trawl	36° 44.4'	121° 58.6'	287	85	116
CTD	36° 42.5'	121° 54.5'	91	81	115
Trawl	36° 42.5'	121° 54.5'	91	85	115
CTD	36° 38.7'	121° 51.8'	46	36	111
Trawl	36° 38.7'	121° 51.8'	46	25	111
Trawl	36° 39.3'	121° 56.8'	73	85	112
CTD	36° 39.3'	121° 56.8'	73	63	112

MONTEREY BAY OUTSIDE-DAY

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	36° 40'	122° 10'	1134	520	1002
CTD	36° 46.3'	122° 16.1'	823	520	1003
CTD	36° 46.3'	122° 28.4'	2103	520	1004
CTD	36° 40'	122° 22.3'	1737	520	1005
CTD	36° 33.7'	122° 16.2'	2560	520	1006
CTD	36° 33.7'	122° 28.4'	2743	520	1007
CTD	36° 40'	122° 34.6'	2377	520	1008
CTD	36° 46.3'	122° 40.7'	2149	520	1009
CTD	36° 33.7'	122° 40.7'	2743	520	1010

MONTEREY BAY OUTSIDE-NIGHT

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	36° 35'	122° 10.5'	2304	520	110
Trawl	36° 35'	122° 10.5'	2304	85	110
Trawl	36° 35'	122° 10.5'	2304	25	110
CTD	36° 35'	122° 02'	608	520	109
Trawl	36° 35'	122° 02'	608	85	109
CTD	36° 38.8'	122° 03'	900	520	113
Trawl	36° 38.8'	122° 03'	900	85	113
CTD	36° 42'	122° 06.5'	1920	520	117
Trawl	36° 42'	122° 06.5'	1920	85	117
Trawl	36° 46.4'	122° 09'	966	85	118
CTD	36° 46.4'	122° 09'	966	520	118

DAVENPORT-DAY

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	36° 52.6'	122° 10'	91	81	1011
CTD	36° 52.6'	122° 22.3'	1180	520	1012
CTD	36° 52.6'	122° 34.6'	1600	520	1013
CTD	36° 52.6'	122° 47'	2286	520	1014
CTD	36° 52.6'	122° 59.3'	2697	520	1015
CTD	36° 59'	122° 53'	1411	520	1016
CTD	37° 05'	122° 47'	686	520	1017
CTD	37° 05'	122° 34.6'	119	110	1018
CTD	37° 05'	122° 22.3'	59	50	1019

DAVENPORT-NIGHT

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	36° 59'	122° 17.5'	82	72	123
Trawl	36° 59'	122° 17.5'	82	85	123
CTD	36° 59'	122° 22.5'	128	118	124
Trawl	36° 59'	122° 22.5'	128	85	124
CTD	36° 59'	122° 25.5'	446	436	125
Trawl	36° 59'	122° 25.5'	446	85	125
CTD	36° 59'	122° 35.5'	432	412	126
Trawl	36° 59'	122° 35.5'	432	85	126
Trawl	36° 59'	122° 45.5'	1045	85	127
CTD	36° 59'	122° 45.5'	1045	520	127

PESCADERO-DAY

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	37° 10.7'	122° 28.4'	68	58	1020
CTD	37° 10.7'	122° 40.7'	110	100	1021
CTD	37° 10.7'	122° 53'	421	410	1022
CTD	37° 10.7'	123° 05.3'	869	520	1023
CTD	37° 16.5'	123° 11.4'	1189	520	1024
CTD	37° 22.3'	123° 05.3'	823	520	1025
CTD	37° 22.3'	122° 53'	201	190	1026
CTD	37° 22.3'	122° 40.7'	88	78	1027
CTD	37° 22.3'	122° 28.4'	27	20	1028

PESCADERO-NIGHT

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	37° 16.5'	122° 34'	82	72	131
Trawl	37° 16.5'	122° 34'	82	85	131
CTD	37° 16.5'	122° 39'	95	85	132
Trawl	37° 16.5'	122° 39'	95	85	132
CTD	37° 16.5'	122° 49'	184	174	133
Trawl	37° 16.5'	122° 49'	184	85	133
CTD	37° 16.5'	122° 59'	518	508	134
Trawl	37° 16.5'	122° 59'	518	85	134
Trawl	37° 16.5'	123° 09'	950	85	135
CTD	37° 16.5'	123° 09'	950	520	135

GULF OF THE FARALLONES-DAY

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
TBD					

GULF OF THE FARALLONES-NIGHT

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	37° 47.5'	122° 52'	55	45	139
Trawl	37° 47.5'	122° 52'	55	25	139
CTD	37° 42'	122° 54.5'	55	45	138
Trawl	37° 42'	122° 54.5'	55	25	138
CTD	37° 35.8'	122° 49.9'	74	64	237
Trawl	37° 35.8'	122° 49.9'	74	25	237

FARALLONES OUTSIDE-DAY

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	37° 30.8'	122° 59.3'	229	220	1029
CTD	37° 30.8'	123° 11.6'	1280	520	1030
CTD	37° 30.8'	123° 24'	2415	520	1031
CTD	37° 30.8'	123° 36.3'	3215	520	1032
CTD	37° 38.4'	123° 36.3'	3338	520	1033
CTD	37° 46.2'	123° 36.3'	2697	520	1034
CTD	37° 46.2'	123° 24'	1509	520	1035
CTD	37° 46.2'	123° 11.6'	128	118	1036

FARALLONES OUTSIDE_NIGHT

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	37° 39.5'	123° 02.5'	108	98	152
Trawl	37° 39.5'	123° 02.5'	108	85	152
CTD	37° 39.5'	123° 12.5'	1301	520	154
Trawl	37° 39.5'	123° 12.5'	1301	85	154
CTD	37° 44.6'	123° 08.3'	91	81	156
Trawl	37° 44.6'	123° 08.3'	91	85	156
CTD	37° 53'	123° 19'	91	81	160
Trawl	37° 53'	123° 19'	91	85	160
Trawl	37° 53'	123° 30'	1328	85	162
CTD	37° 53'	123° 30'	1328	520	162

POINT REYES-DAY

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	38° 1.6'	123° 05.5'	64	54	1046
CTD	38° 1.6'	123° 17.8'	119	109	1045
CTD	38° 1.6'	123° 30.1'	137	127	1037
CTD	38° 1.6'	123° 42.4'	2560	520	1038
CTD	38° 1.6'	123° 54.7'	3475	520	1039
CTD	38° 10'	124° 07'	3658	520	1040

POINT REYES-NIGHT

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	38° 10'	123° 0'	55	45	165
Trawl	38° 10'	123° 0'	55	25	165
CTD	38° 9.5'	123° 5'	73	63	166
Trawl	38° 9.5'	123° 5'	73	85	166
CTD	38° 10'	123° 10'	91	81	167
Trawl	38° 10'	123° 10'	91	85	167
CTD	38° 10'	123° 17'	120	110	168
Trawl	38° 10'	123° 17'	120	85	168
CTD	38° 10'	123° 22'	183	173	170
Trawl	38° 10'	123° 22'	183	85	170
Trawl	38° 10'	123° 29'	400	85	171
CTD	38° 10'	123° 29'	400	390	171

FORT ROSS-DAY

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	38° 28'	124° 24.0'	3500	520	4031
CTD	38° 18.5'	124° 07.7'	3600	520	4030
CTD	38° 18.5'	123° 54.7'	2835	520	1041
CTD	38° 18.5'	123° 42.4'	1463	520	1042
CTD	38° 18.5'	123° 30.1'	274	264	1043
CTD	38° 18.5'	123° 17.8'	110	100	1044
CTD	38° 18.5'	123° 10'	83	73	1048

FORT ROSS-NIGHT

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	38° 28'	123° 14'	53	43	183
Trawl	38° 28'	123° 14'	53	25	183
CTD	38° 28'	123° 23.2'	115	105	453
Trawl	38° 28'	123° 23.2'	115	85	453
CTD	38° 28'	123° 42.6'	910	520	454
Trawl	38° 28'	123° 42.6'	910	85	454
Trawl	38° 28'	124° 03.5'	3263	85	455
CTD	38° 28'	124° 03.5'	3263	520	455

NAVARRO-DAY

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	38° 50.0'	124° 37.0'	3500	520	4035
CTD	38° 50.0'	124° 20.0'	3300	520	4034
CTD	38° 50.0'	124° 04'	1805	520	4033
CTD	38° 50.0'	123° 47.0'	111	101	4032

NAVARRO-NIGHT

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	39° 08'	123° 47'	73	63	461
Trawl	39° 08'	123° 47'	73	25	461
CTD	39° 08'	124° 00'	404	394	463
Trawl	39° 08'	124° 00'	404	85	463
CTD	39° 08'	124° 19'	2153	520	464
Trawl	39° 08'	124° 19'	2153	85	464
Trawl	39° 08'	124° 36'	3292	85	465
CTD	39° 08'	124° 36'	3292	520	465

DELGADA-DAY, SOUTH

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	39° 30'	124° 53'	2807	520	4039
CTD	39° 30'	124° 35'	2300	520	4038
CTD	39° 30'	124° 17'	1800	520	4037
CTD	39° 30'	124° 02'	630	520	4036

DELGADA-NIGHT

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	39° 50'	123° 55'	65	55	471
Trawl	39° 50'	123° 55'	65	85	471
CTD	39° 50'	124° 06.5'	236	226	473
Trawl	39° 50'	124° 06.5'	236	85	473
CTD	39° 50'	124° 24'	1600	520	474
Trawl	39° 50'	124° 24'	1600	85	474
Trawl	39° 50'	124° 43'	1344	85	475
CTD	39° 50'	124° 43'	1344	520	475

DELGADA-DAY, NORTH

OPS	Latitude	Longitude	Depth(m)	Wire Out(m)	Station#
CTD	39° 50'	124° 58'	1830	520	4059
CTD	40° 05'	124° 54.3'	1200	520	4058
CTD	40° 05'	124° 41.3'	1000	520	4057
CTD	40° 05'	124° 28.3'	678	520	4056
CTD	40° 05'	124° 15.2'	160	150	4055

NWFSC STATIONS

FALSE CAPE

Latitude	Longitude
40° 30'	124° 30.6'
40° 30'	124° 37.2'
40° 30'	124° 43.8'
40° 30'	124° 50.4'
40° 30'	124° 57'
40° 30'	125° 3.6'
40° 30'	125° 10.2'

TRINIDAD HEAD

Latitude	Longitude
41° 0'	124° 16.2'
41° 0'	124° 22.8'
41° 0'	124° 29.4'
41° 0'	124° 36'
41° 0'	124° 42.6'
41° 0'	124° 49.2'
41° 0'	124° 55.8'

FLINT ROCK HEAD

Latitude	Longitude
41° 30'	124° 15.6'
41° 30'	124° 22.2'
41° 30'	124° 28.8'
41° 30'	124° 35.4'
41° 30'	124° 42'
41° 30'	124° 48.6'
41° 30'	124° 55.2'

BROOKINGS

Latitude	Longitude
42° 0'	124° 24.6'
42° 0'	124° 31.2'
42° 0'	124° 37.8'
42° 0'	124° 44.4'
42° 0'	124° 51'
42° 0'	124° 57.6'
42° 0'	125° 4.2'

GOLD BEACH

Latitude	Longitude
42° 30'	124° 36.6'
42° 30'	124° 43.2'
42° 30'	124° 49.8'
42° 30'	124° 56.4'
42° 30'	125° 3'
42° 30'	125° 9.6'
42° 30'	125° 16.2'

BANDON

Latitude	Longitude
43° 0'	124° 37.8'
43° 0'	124° 44.4'
43° 0'	124° 51'
43° 0'	124° 57.6'
43° 0	125° 4.2'
43° 0	125° 10.8'
43° 0	125° 17.4'

COOS BAY

Latitude	Longitude
43° 30	124° 21.6'
43° 30	124° 28.2'
43° 30	124° 34.8'
43° 30'	124° 41.4'
43° 30'	124° 48'
43° 30'	124° 54.6'
43° 30'	125° 1.2'

HECETA HEAD

Latitude	Longitude
44° 0'	124° 34.8'
44° 0'	124° 42'
44° 0'	124° 49.2'
44° 0'	124° 56.4'
44° 0'	125° 3.6'
44° 0'	125° 10.8'
44° 0'	125° 18'

NEWPORT

Latitude	Longitude
44° 30'	124° 21'
44° 30'	124° 28.2'
44° 30'	124° 35.4'
44° 30'	124° 42.6'
44° 30'	124° 49.8'
44° 30'	124° 57'
44° 30'	125° 4.2'

LINCOLN CITY

Latitude	Longitude
45° 0'	124° 6.6'
45° 0'	124° 13.8'
45° 0'	124° 21'
45° 0'	124° 28.2'
45° 0'	124° 35.4'
45° 0'	124° 42.6'
45° 0'	124° 49.8'

TILLAMOOK

Latitude	Longitude
45° 30'	124° 9.6'
45° 30'	124° 16.8'
45° 30'	124° 24'
45° 30'	124° 31.2'
45° 30'	124° 38.4'
45° 30'	124° 45.6'
45° 30'	124° 38.4'

COLUMBIA RIVER

Latitude	Longitude
46° 0'	124° 19.2'
46° 0'	124° 26.4'
46° 0'	124° 33.6'
46° 0'	124° 40.8'
46° 0'	124° 48'
46° 0'	124° 55.2'
46° 0'	125° 2.4'

WILLAPA BAY

Latitude	Longitude
46° 30'	124° 16.8'
46° 30'	124° 24'
46° 30'	124° 31.2'
46° 30'	124° 38.4'
46° 30'	124° 45.6'
46° 30'	124° 52.8'
46° 30'	125° 0'

TAHOLAH

Latitude	Longitude
47° 0'	124° 35.4'
47° 0'	124° 42.6'
47° 0'	124° 49.8'
47° 0'	124° 57'
47° 0'	125° 4.2'
47° 0'	125° 11.4'
47° 0'	125° 11.4'

GRAYS HARBOR

Latitude	Longitude
47° 30'	124° 42.6'
47° 30'	124° 49.8'
47° 30'	124° 57'
47° 30'	125° 4.2'
47° 30'	125° 11.4'
47° 30'	125° 18.6'
47° 30'	125° 11.4'

LA PUSH

Latitude	Longitude
48° 0'	125° 14.4'
48° 0'	125° 21.6'
48° 0'	125° 28.8'
48° 0'	125° 36'
48° 0'	125° 43.2'
48° 0'	125° 50.4'
48° 0'	125° 57.6'
48° 0'	126° 4.8'